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ARTICLE REVIEW

Analysis of the effectiveness of Manual Treatment Techniques in Endodontic Procedures

Análisis de la efectividad de las técnicas de tratamiento Manual en Procesos de Endodoncia

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ABSTRACT

Introduction: one of the most common conditions in the field of dentistry is the presence of patients with dental caries, most of whom have not been treated in time and consequently have infections of the pulp and nerve of the tooth.
Objective: to analyze the effectiveness of manual treatment techniques in endodontic procedures in patients who have undergone this type of treatment.
Methods: the research was done through a systematic review of the bibliography, applying the PRISMA methodology, taking as reference secondary sources particularly from the last five years, such as: articles from indexed journals of the Redalyc, ScienceDirect; Scielo, Dialnet bases; degree theses; the selection of the documents was done applying the inclusion and exclusion criteria according to the correspondence with the variables object of the present study.
Results: It was determined that manual endodontic techniques are highly effective, given that an average of eight out of ten patients do not generate postoperative symptoms. The studies analyzed also agree that manual endodontic techniques are more effective in single-radicular treatments, but this does not imply that they are not applicable in multi-radicular treatments if the corresponding protocols are taken into account.
Conclusions: manual treatment techniques in endodontic procedures reach an effectiveness of up to eighty percent; due to the diversity of materials, instruments and the constant evolution of the techniques, it implies a permanent clinical update on the part of the professional.

Keywords: Endodontics; Dentistry; Dental Caries; Patient; Patient Care.

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RESUMEN

Introducción: una de las afecciones más comunes que se presenta en la rama de la Odontología, es la presencia de pacientes con caries dental que en su gran mayoría no han sido tratados a tiempo y en consecuencia presentan infecciones a la pulpa y el nervio del diente.
Objetivo: analizar de la efectividad de las técnicas de tratamiento manual en procesos de Endodoncia, en aquellos pacientes que se ha implementado este tipo de tratamientos.
Métodos: la investigación se hizo mediante una revisión sistemática de la bibliografía, aplicando la metodología PRISMA, tomando como referencia fuentes secundarias particularmente de los últimos cinco años, tales como: artículos de revistas indexadas de las bases Redalyc, ScienceDirect; Scielo, Dialnet; tesis de grado; la selección de los documentos se hizo aplicando los criterios de inclusión y exclusión de acuerdo a la correspondencia con las variables objeto del presente estudio.
Resultados: Se determina que las técnicas manuales de Endodoncia son altamente efectivas, dado que en promedio ocho de cada diez pacientes no generan síntomas posoperatorios. Los estudios analizados coinciden también que las técnicas manuales de Endodoncia tienen mayor efectividad en tratamientos monorradiculares, sin que ello implique la no aplicabilidad en tratamientos multirradiculares si se toman en cuenta los protocolos correspondientes.
Conclusiones: las técnicas de tratamiento manual en procesos de Endodoncia alcanzan una efectividad de hasta un ochenta por ciento; debido a la diversidad de materiales, instrumentos y la constante evolución de las técnicas, implica una permanente actualización clínica por parte del profesional.

Palabras Claves: Endodoncia; Odontología; Caries Dental; Paciente; Atención al Paciente.

INTRODUCTION

Currently, one of the most common conditions in the field of dentistry is the presence of patients with dental caries, the vast majority of whom have not received timely treatment and consequently develop infections in the pulp and nerve of the tooth. Therefore, after a thorough diagnosis, endodontic treatment is often recommended. These treatments vary depending on the tooth's roots; they can be single-rooted, double-rooted, or multi-rooted.

In this context, a systematic review of scientific studies is conducted to objectively substantiate the theoretical and technical understandings of manual endodontic procedures and their effectiveness. Differences and similarities are established between the manual techniques and the most commonly used mechanized techniques in endodontic treatments. Furthermore, reference is made to the retreatment treatments currently offered as alternatives for cases of endodontic failure, all within the framework of professional ethics and patient safety.

It is important to remember that endodontics is a procedure performed to "kill the nerve" of a tooth when it causes ongoing pain and cannot be resolved in any other way. Treatment usually requires a single appointment; however, appointments may vary depending on the complexity of the problem.[1]

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Endodontics is one of the most complex procedures available today due to the wide variety of materials and instruments available, combined with the constantly evolving diversity of techniques in dentistry. Therefore, properly diagnosing the patient's condition is very useful for the professional to select and implement the methods, techniques, and skills that best reflect the anatomical complexity of each case.

In the field of dentistry, endodontics is a dental treatment that consists of removing the damaged pulp of the tooth and then filling the pulp cavity with inert material, and then completely sealing it and preserving the tooth, with the aim of not developing problems again. Endodontic treatment consists of removing what is considered dental pulp (nerve of the tooth), which can be removed totally or partially, depending on the degree of affection in the patient; said pulp has a coronal portion and a radicular portion that extends through the roots of the tooth. This tissue is composed of nerves and blood vessels. That is why the manual technique is recommended for single-root treatments, without implying that this technique cannot be implemented in multi-root treatments if the protocols are followed properly.[2]

Regarding root canal treatments, it is known that according to a study carried out to determine the reasons why root canal treatments are performed in dental clinics at a public university in Mexico City, they concluded that the main reason why root canal treatments were performed was irreversible pulpitis caused by cavities. In a population of 819 patients, 59,5 % had cavities that had not received any previous dental treatment and that have affected the dental pulp, as a result of which effects such as loss of teeth, malocclusion problems, phonetic problems among others are observed. It concludes that cavities continue to be a public oral health problem. Behavior that is still very common today.[3]

An endodontic treatment should be implemented when the infection caused by caries has affected the dental pulp. To save the tooth, a root canal treatment is required to prevent the infection from reaching the bone structure. According to the WHO, there are some symptoms that indicate whether the Endodontic Treatment is necessary, for example: tooth pain, inflammation of the area, discharge of yellowish or white liquid, discomfort when eating cold foods or cold drinks.[4]

Regarding manual endodontic techniques, the authors Pico J, et al.,[5] consider that their application, despite the advances it has had, fails in many cases. These failures can occur due to: "bacterial infection as a result of omissions in cleaning, treatment and filling, iatrogenic events or reinfection of the root canal system when the coronal seal is lost after the completion of the root canal treatment." Medically, these failures are known as: Underfilling; Overfilling; Coronal leakage and Incomplete treatment.

Furthermore, they maintain that: "to reduce bacterial loads during retreatment, it is important to remove the filling material and gain access to the apical foramen, which in turn facilitates proper cleaning, shaping and disinfection of the root canal system." Indicators for retreatment processes are: symptoms of pain, fissures or edema that occur after endodontic treatment, generally several months or even years. For the success of endodontic retreatment: adequate diagnosis and prognosis, use of relevant materials and instruments. The appropriate tools to perform the grinding and shaping of the root cavity using manual techniques are: K files, Hedstrom files and Gates Glidden files.[6]

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Castillo Mendoza F.,[3] maintains that a treatment of the single-root canal system, applying manual techniques, has a success rate close to 90 %; meanwhile, the success rate reported for retreatment ranges between 60 % and 70 %". This behavior may be due to limitations and accidents caused in the first treatment. The second treatment consists of the reconfiguration of the root canals and the removal of the previous filling, which is performed with manual or rotary treatment. The most effective instruments are manual files in the removal of gutta-percha; while in root retreatment using the rotary system (Ni - Ti), it is more effective and safer, avoiding apical extrusion of debris.

Mechanized endodontic treatment is particularly important in anatomically difficult root canals and is included in the service profile of every modern dental practice. In recent years, mechanical preparation treatments using nickel and titanium instruments have been in significant demand; however, manual treatment is the standard of care, considering that it cannot be completely dispensed with in very narrow canals. Given the diversity of current techniques, professionals need greater guidance on the importance of step-back, step-down, crown-down, and double-flare techniques.[7]

Currently, endodontics is a routine treatment performed in one or two visits depending on the pulp diagnosis. The effectiveness of radical endodontic treatment in a non-vital pulp in a single visit reaches 81,87 % of patients who evolve asymptomatic; only 18,13 % presented symptoms of apical periodontitis before the week of treatment. Consequently, endodontic treatment in a single visit in patients with non-vital pulp is feasible for any pulp pathology, resulting in benefits for both the operator and the patient.[8]

Authors such as Álvarez L, et al,[6] maintain that biomechanical preparation is crucial for the success of endodontic treatment, "90 % of patients do not suffer postoperative pain; 96,67 % of treatments were effective as there were no signs of inflammation; only 3,3 % of the evolutionary radiographic examinations show images of chronic inflammatory processes". From the above, it can be inferred that the step-back treatment technique in Endodontic treatment is very effective, since most of the treated patients do not present postoperative pain or inflammation. This technique is recommended to be applied especially when the canal is very curved and/or narrow since it allows the canal to be shaped and its obturation to be easier and more precise.

The most commonly used instruments in endodontics are files, which have evolved significantly, minimizing risks and increasing their effectiveness and efficiency. However, their limitations are their high cost and single-use nature. With all this equipment, a professional spends an average of 45 minutes performing an endodontic treatment. Two sessions are often required to complete the procedure. Therefore, if all the requirements are not met, success rates tend to drop.

Root canal unfilling involves the partial or total removal of filling material from the canal system that is not fulfilling its intended function for the tooth to remain in the mouth. There are several methods for this treatment, the most commonly used being manual removal with Hedstrom files and heat or chemicals, and rotary ultrasound systems.[9]

It is vital to understand the preamble, context, and tools involved in an endodontic procedure and its ramifications leading to treatment delivery in order to analyze the results that can be achieved between manual and mechanized treatments.

Based on the above, the objective is defined as: to analyze the effectiveness of manual treatment techniques in endodontic processes, in those patients who have undergone this type of treatment.

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METHODS

The research was conducted through a systematic review of the literature using the PRISMA methodology, using secondary sources from the last five years, including articles from journals indexed in PubMed, Scopus, Redalyc, ScienceDirect, Scielo, and Dialnet, as well as undergraduate theses. Documents were selected based on inclusion and exclusion criteria based on their correspondence with the variables targeted by the present study.

A review matrix was used as a data collection tool to synthesize the theories, characteristics, and motivations of various authors regarding the effectiveness of manual endodontic techniques. This allowed us to identify concordant and divergent criteria that contributed to the construction of an objective view of the problem and, from there, to draw our conclusions. Since this is a descriptive bibliographic study, no specific study population was selected; the results are the product of an analysis of 15 documents taken from secondary sources. The research was conducted by student researchers from the Autonomous University of the Andes with the aim of sharing knowledge that contributes to obtaining significant learning for the efficient development of the profession.

DEVELOPMENT

The results of the analysisapplying the PRISMA methodologycan be seen in Table 1.

Table 1. Significant results of the systemic review.

Document type	Keywords	Database	Items obtained	Discarded items	Used items
Meta-analysis	Manual treatment techniques, Endodontics	PubMed	10	6 were discarded for being in a foreign language 2 excluded for being out of time	2
Systematic review	Manual treatment techniques, endodontics, unblocking, mechanized	Scopus	4	2 discarded for not having repetitive informatio n	2
Clinical trial	Manual treatment techniques, Endodontics, root canal, success,	Web of Science	15	3 excluded for being in a foreign language 6 were dismissed for not	6

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Document type	Keywords	Database	Items obtained	Discarded items	Used items
				providing relevant information to the investigation 2 repeated	
Bibliographic Review	Treatments, root canals, dental, endodontics, efficacy, single-rooted.	Scielo	8	5 were discarded for being in a foreign language 2 repeated	1
Systematic review	Root canal unfilling, instruments, endodontics.	Redalyc	3	2 ruled out for being out of time	1
Systematic review	Endodontics,endodontic treatment, efficacy.	Dialnet	1	0	1
Systematic review	Endodontics, mechanical procedures, file, consequences.	Unal Repository	2	0	2
Total					15

Although there is limited information on the effectiveness of manual endodontic treatments, according to the documentary analysis presented, manual procedures have been more successful than mechanized procedures, making them a safer and more viable option for the practice. The most widely applied unblocking technique is mechanized retreatment with ProTaper files, which yields average results in the middle third, but with better results in the apical third. Regarding unblocking time, mechanized files required less time.

As a summary, we present some data collected from this research work to demonstrate the most common types of treatments. It can be seen that single-root treatments are the most frequently applied (46,20 % of patients), followed by double-root treatments (35,10 %), and multi-root treatments (18,71 %). For the success of endodontic treatments, the authors analyzed agree on common points: adequate diagnoses, relevant materials and instruments, and professional expertise.

There are a number of small parameters that encompass each of the procedures analyzed in this research, which create a contrast between knowledge, effectiveness, and preferences.

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Soriano M, et al,[7] state that although the manual system requires more time to be used, it has the advantage of being much safer (lower risk of fractures, perforations, blockages) and is easily accessible to the professional. Using a chemical substance in this treatment will help the solubility of gutta-percha and endodontic cement, dissolving them and providing an antimicrobial action; the most commonly used are chloroform, xylene, eucalyptol, among others. However, xylol is recommended, which despite being somewhat irritating, has a high dissolving power 5 minutes after placement, plasticizing the gutta-percha satisfactorily for subsequent removal.

Mendoza CastleF.,[3] states that root canal unfilling is a treatment performed on a previously treated tooth, seeking to remove all filling material from the canals in order to perform a new endodontic treatment. In the context of unfilling techniques, we also find manual and mechanized ones. Mechanized files are a proposal that applies reciprocating or rotary systems that have been proven effective in removing root filling material, with a wide variety of Ni-Ti rotary instruments from which one can select according to experience in their use, concluding that: "mechanized unfilling is 70 % effective while manual unfilling is 30 % effective; the most commonly used files are Protaper Retreatment mechanized files with 27 %, while Hedstrom manual files hover around 16 %."

According to Días V,[8] regarding patient safety, he states that Endodontic treatment can generate adverse events that affect the safety of the dental patient and includes Endodontics as an isolated treatment in patient safety, thus being able to analyze which are the most common adverse events that occur during this treatment, allowing the development of guides and protocols aimed at improving the oral health and well-being of the patient.

Dental professionals must be aware of the health problems that can arise in patients undergoing root canal treatment, even if their treatment is not intentional.

Valdez Sosa A,[9] regarding the level of confidence of students to perform an Endodontic process in their formative stage "a high confidence score was found, 8.51 when performing a single-root Endodontics, the lowest scores reached were when determining the working length and the obturation of the canals with an average of 8.19 and 8.01", other significant variables to generate the level of confidence were previous experience, perception of complication and having had a complication. In this context, and as a result of it, it can be said that there is a positive relationship between these variables and confidence.

Among the factors to be considered, we also find the future consequences of mechanized treatments regarding the use of irrigating solutions that, according to Navarrete, L.,[10] from 2 % to 20 % of cases end in a vertical fracture of the root, causing the subsequent loss of the tooth.

The documents studied agree that effective treatment requires compliance with basic aspects: preparation and the use of appropriate instruments such as 3D x-rays, rotary treatment motors, ultrasound equipment, among others, to address complex situations. The protocol to follow in single-root endodontic treatment is summarized in the following table (Table 2).

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Table 2. Protocol for single-root endodontic treatment.

Perform single-root endodontic treatment
Anesthetize the tooth that will undergo root canal treatment
Perform the isolation of the tooth
Perform the cameral opening (access)
Determine the working length of the canal using a digital radiograph
Perform irrigation of the root canal system
Perform cleaning and shaping of the root canal system
Perform obturation of the root canal system
Interpret X-rays before, during and after
Evaluate the quality of the canal filling
Know how to place a post in the root canal and how to use it to retain a restoration

Source: Adapted fromValdez SosaTO, et al.[9]

The mechanical endodontic procedure, and its effectiveness, as mentioned before, depend on the use of the material, files for example, according to Cortés, A., [11] those made of NiTi alloy, lead to better effectiveness and low probability of mishaps such as excessive perforations or lacerations, which greatly benefits the patient.

Regarding the effectiveness of manual endodontic treatments, some data are presented in this document in the results section, which demonstrate the high effectiveness of this type of treatment, provided the procedures are performed properly and the practitioner demonstrates expertise. However, there is no uniform criterion for measuring effectiveness, since various categories are used, for example: postoperative reactions, preference for single-root treatments over manual techniques, where they appear to be effective. Another study shows a preference among patients for mechanized techniques. It seems that manual treatment techniques do not effectively meet client expectations.

Hernández Espino RJ,[12] in his study of the fracture resistance of upper premolars with endodontic treatments through conservative and traditional access, observed that there is no difference in the fracture resistance of premolars when comparing the types of conservative and traditional access.

A very important factor to consider is the level of patient satisfaction and their choice. Based on the data already mentioned, patients prefer mechanical procedures; however, they also consider the level of pain they have experienced over the number of sessions. According to Campaña L.,[13] although there is not a big difference in choice, most patients prefer endodontic procedures that are performed in a single appointment, compared to those that require at least two appointments.

Another risk that must be taken into account is endodontic infections, which, although they may not seem relevant, depend on the age of the patient "differences can be observed between cells that live in young and mature biofilms."[14]

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Similarly, there is no evidence of a standardized protocol for each technique that complies with socially sustainable and economically viable standards. In this context, the use of CT scans and/or X-rays as a guiding method for endodontic procedures has been innovative, allowing for less invasive and complication-free treatment. Scientific research in these areas has not had much impact, as it is applied more frequently to more complex procedures. The results of this research can help dental professionals become aware of the health problems that treatment can cause in patients.

Variety of Techniques and Evolution in Dentistry: The complexity of endodontics is recognized due to the diversity of materials, instruments, and techniques available, as well as its constant evolution. This highlights the importance of staying current in clinical practice.

Importance of Diagnosis and Planning: It is important to highlight the importance of a proper diagnosis and prior treatment planning to provide a comprehensive and personalized approach to the patient.

Treatment and Retreatment Results: The effectiveness of the endodontic treatments and retreatments analyzed helps to adequately address future failures and complications.

Concern for Patient Safety: The dentist's ethical and professional consideration is reflected in compliance with safety parameters in endodontic procedures, for the benefit of the patient.

Preference for Mechanized Techniques: Patients have a greater preference for mechanized techniques over manual ones, which gives rise to the initiative to investigate the reasons for this preference and project it into the improvement of manual techniques.

CONCLUSIONS

This research provides a comprehensive overview of key aspects related to endodontics, including technique effectiveness, treatment outcomes, patient preferences, and safety concerns. The need to understand the effectiveness of manual endodontic techniques is highlighted, suggesting a genuine concern for improving clinical outcomes in this field.

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